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Stabilometric Platform Measurements to Determine Post-Deployment Adaptation

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STABILOMETRIC PLATFORM MEASUREMENTS TO DETERMINE POST-DEPLOYMENT ADAPTATION

ABSTRACT

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Introduction

Posttraumatic stress disorder (PTSD) can affect anyone who undergoes a potentially traumatic event. Past cases show that any traumatic event could lead to possible symptoms of PTSD. It is necessary to understand the symptoms, as well as some of the current and future treatment options available to those who suffer from PTSD. It is also valuable to study those who experience a traumatic event and demonstrate resilience. Past and future studies will also provide insight to the current goal of the military to maintain individual and unit mental health. Identifying and preventing PTSD, while enhancing resilience is the ultimate goal of current military research efforts. This paper will focus on the historical context, symptoms, past research and treatment of PTSD, as well as the possible use of stabilometric platforms as a behavioral measurement within the Comprehensive Soldier Fitness program.

Historical Background

War produces a stress reaction, and this reaction has taken on many forms throughout history. A severe form of this reaction is PTSD. It is important to understand the historical context behind PTSD since it shows how psychologists first identified the disorder and how they first developed interventions. The first documented cases were made by Swiss physicians who recognized the symptoms of PTSD. They used the term nostalgia to characterize someone who was melancholy, exhibited disturbed sleep, and anxiety (Bentley, 2005).

However, throughout the years, differing diagnoses referred to the disorder by different names. During the Civil War, the disorder's name was Soldier's heart. It was characterized by tremors, self inflicted wounds, and behavioral changes (Damore, 2010). The Civil War also had instances where Soldiers without symptoms would go home and collapse with emotional illness (Bentley, 2005). The Civil War was the first conflict that utilized major advances in tactics and

weaponry. As a result of this technological development, psychological symptoms became a recurring theme amongst veterans. This was also the first war in which commanders pleaded with their chain of command and their politicians to enact some form of psychiatric screening to ensure that people with emotional disorders could not enlist (Bentley, 2005).

World War I produced another generation of American Soldiers that developed some form of PTSD. Soldiers in the field recognized PTSD and referred to it as “shell shock.” The belief was that the constant bombardment of shells would disrupt the chemical and electrical signals in the brain thus causing tremors, emotional instability, and the new symptom known as the “thousand-yard stare” (Damore, 2010). After WWI, military psychologists were confused and unable to treat the symptoms of “shell shock.” As a result they went back to Civil War doctrine and felt that it was necessary to create a better screening process in order to screen out those who were psychologically unfit for service (Bentley, 2005).

World War II veterans saw symptoms similar to their WWI counterparts. It soon became clear, though, that these symptoms did not happen to those who were weak in character. Combat fatigue once against became the classification for PTSD (Damore, 2010). Unlike the Civil War and WWI, the military placed those who showed signs of combat fatigue in the rear for a rest and relaxation period. After this period the Soldiers would return fit for duty. It soon became clear that rotating troops could mitigate the effects of combat fatigue (Damore, 2010).

In Vietnam, 2.8 million Soldiers served in the U.S. Armed Forces. This war presented different stressors than those of the preceding wars. Guerrilla tactics, poor identification of hostiles within the local populace, and lack of support back home created an environment in which the Soldier had poor social support. As a result Soldiers would undergo a transformation in their sense of reality (Bentley, 2005). They used this coping mechanism to protect their senses

and preserve what little values they had left. Many Soldiers would return home with little or no help integrating back into society. Many Soldiers, once home, would begin to experience flashbacks, night terrors, and exhibit maladaptive coping behavior. Vietnam brought in the term of posttraumatic stress disorder as we know it today.

Posttraumatic stress disorder is not only limited to veterans. Many other cases involve trauma from car accidents, sexual assault, and incidences such as September 11th. Cases, such as September 11th, show that PTSD can affect the general populace. Even with indirect exposure, the 9/11 attacks appear to be responsible for causing clinically significant levels of PTSD symptoms within the U.S. population (Marshall, 2007). Attacks such as 9/11 put a new face to PTSD, and as with the veterans of previous wars PTSD diagnosis continues to evolve. 9/11 was the first documented case where people began displaying exaggerated fears of being personally harmed in an act of terror (Marshall, 2007).

Most of the historical context on PTSD has focused on white males who lived in industrialized nations during a time of war. It is also important to note that the female population may also experience PTSD under similar circumstances. Historical figures show that women are twice as likely to experience PTSD as their male counter parts (Tolin and Foa, 2008). Women veterans are not only subject to the same environment as men, but women, as a whole, are also more likely to suffer from sexual and physical abuse. This abuse can occur within the military and within the civilian populace. A review of 25 years of PTSD data also showed that PTSD in women was most likely to come in the form of sexual assault and child abuse, while men were more likely to experience war, witnessing a death, a disaster, and getting an injury (Tolin and Foa, 2008).

Prevalence and Symptoms

In 1950, psychologists conducted a study in which they screened 200 psychiatric patients for traumatic war neurosis. Of the 200, they reported that 10% exhibited symptoms (Friedman, Schnurr, & McDonough Coyle, 1994). A similar study used Israeli Soldiers, who fought during the war against Lebanon in 1982. In the group that showed symptoms during the war, 62% still showed signs after one year, 56% two years later, and 43% three years later. The estimate for the non-veteran PTSD group showed 14%, 17%, and 10% respectively (Friedman, Schnurr, & McDonough Coyle, 1994). Vietnam Veterans also provide evidence for the prevalence of PTSD. The National Vietnam Veterans Readjustment Study shows the current prevalence to be at just over 15%. With regards to female veterans, PTSD rates were 8.5%. Of those who experienced war zone exposure, 30.9% of men and 26.9% of women would develop a lifetime case of PTSD (Ozer, et al., 2008). These studies show that prevalence for PTSD, during any time span, may be between 5 to 15% for those with a subclinical form. However for those who experience daily stress, such as Soldiers, policemen, and firemen, prevalence may be as high as 75% (Damore, 2010).

In order for PTSD to develop, a stressor must be present. It is necessary to define what this stressor, or traumatic event, is in order to help explain an individual's symptoms and work towards a treatment. A traumatic event is an event in which a person experienced, witnessed, or confronted the possibility of death or serious injury to themselves or others around them (Damore, 2010).

Diagnosing the symptoms of PTSD is a common method of obtaining the number of people within a populace who have PTSD. PTSD is unusual in that it has many signs and symptoms that psychologists can misdiagnose as some other psychiatric disorder. Psychologists

most often misdiagnose PTSD as depression. Every individual is different, and as a result of these differences each individual exhibits different symptoms of PTSD. This depends on the type of trauma experienced, the hardiness of the individual, and the individual's prior mental and physical state. With that said, PTSD is most common in military veterans. Veterans most commonly report intrusive thoughts, nightmares, social withdrawal, numb feelings, hyper-vigilance, maladaptive behavior, and paranoia (Ozer et al., 2008).

Women who experienced sexual assault also develop symptoms of PTSD. With the rise of PTSD in sexual assault cases, the term *rape trauma syndrome* has entered the psychological literature. Symptoms include social withdrawal, being easily startled, and flashbacks of the incident (Ozer et al., 2008). These symptoms were surprisingly similar to veterans, even though they involved different scenarios and different genders.

Most studies have primarily focused on those who already have PTSD. They detail the symptoms and treat them accordingly. However, what about the individuals who experienced a traumatic event but did not meet the necessary criteria to be diagnosed with PTSD? Those individuals who do not meet these criteria are the ones who have experienced trauma and are experiencing a reduction in symptoms (Friedman, Schnurr, & McDonough Coyle, 1994). Even though there is a reduction, these individuals are not free of symptoms and thus fall into the midpoint between those who experience PTSD and those who are resilient. This middle population is important to study since they have signs of recovery, but ultimately still experience symptoms of PTSD (Friedman, Schnurr, & McDonough Coyle, 1994). These symptoms may still impact marital, family, and social settings. Although many PTSD patients become free of most symptoms, others experience periods of relapse followed by remission (Friedman, Schnurr, &

McDonough Coyle, 1994). These constant cycles can severely reduce an individual's quality of life.

Treatment

Lack of treatment for PTSD patients has serious implications for military, police, and firefighting professions. PTSD can limit an individual's productivity, cause retention problems, and create compensation claims. Not only do such professions need to retain their trained employees, they also need to ensure that their PTSD does not affect their job performance and their colleagues' performance as well.

There are several goals regarding the treatment of PTSD. The ultimate goal is to eliminate all symptoms of PTSD and return to pre-trauma levels (Creamer & Forbes, 2004). This goal is somewhat unrealistic, and as a result there needs to be an emphasis on broader psychosocial therapy. This therapy should allow the individual to focus on relationships, social networking, and occupational functioning. This focus is an intervention method that would allow for the reduction of PTSD symptoms, thus taking the individual closer to the goal of alleviating the symptoms (Creamer & Forbes, 2004). Even though alleviating symptoms is important, emphasis needs to also be placed on building resilience. This is pertinent to someone who remains in the military after a traumatic event since it will allow them to not fall victim to PTSD during another possible traumatic event.

One possible treatment option includes stabilization and engagement. The first part involves ensuring that the veteran is not a threat to themselves and others, which is the stabilization phase. Then it involves establishing a meaningful relationship with the veteran. This will build trust back into the civilian populace, which is important since there is evidence to suggest that the military has elevated rates of childhood trauma which further complicate trust

issues (Merrill et al., 1998). This trauma, coupled with the traumatic event experienced in theater, will adversely affect an individual's ability to have and maintain a meaningful relationship. The ability to intervene and create an open, meaningful relationship is an important step to negating the effects of PTSD.

Clinical experience with PTSD patients proposes that psycho-education about the condition is an important step in early treatment (Flack et al., 1998). Psycho-education is important since it provides an open dialogue between the therapist and the veteran and it allows for a collaborative relationship (Creamer & Forbes, 2004). Psycho-education can address the issue of the Soldier feeling weakened since they developed symptoms. It provides the veteran the necessary facts about etiology of PTSD along the whole spectrum of military service members. Psycho-education also addresses the possible chemical, biological, and environmental factors that could provide possible explanations behind their symptoms. Factors such as neurotransmitters, neuropeptides, and hormones all link to acute psychobiological response to stress, further demonstrating the complexity behind PTSD and the necessity of providing psycho-education (Charney, 2004).

Another possible area of treatment is symptom management. Most veterans feel frightened, susceptible, and incapable of controlling their behaviors (Creamer & Forbes, 2004). Symptom management, usually in the form of stress inoculation training, provides a useful first step in treating PTSD (Meichenbaum, 1985). Such treatment would isolate the component of stress, which includes physiological, cognitive, or behavioral components, and provide some form of relief in aerobic exercise, thought-stopping techniques, or activity scheduling. Symptom management will provide some relief to most moderate cases of PTSD.

Lastly, exposure treatments provide the PTSD patient a viable option for recovery from long-term trauma. Anxiety disorder patients also use this treatment, and empirical evidence in military and civilian populations show that prolonged exposure techniques provide a successful component to the treatment of PTSD (Rothbaum et al., 2000). The prolonged exposure technique is the ability to confront an experience and work through it. The process involves sitting a patient in front of the feared stimuli and keeping the patient engaged until the anxiety is reduced (Creamer & Forbes, 2004). The patient is also required to talk through the incident until the anxiety is reduced. Some consider this treatment superior to a control condition, even though there is considerable variability. Nonetheless, in a study of combat veterans, the results showed there were significant improvements in the symptoms of anxiety, depression, and PTSD, using image exposure (Keane, Fairbank, Caddell, & Zimering, 1989).

Past Research

There have been numerous studies on PTSD since its formal identification in Vietnam. Several studies show how childhood trauma, actual neurosis, and resilience affect PTSD. These studies provide answers to how and why people develop PTSD, while others discuss those who developed hardiness in the face of a traumatic event.

Verhaeghe & Vanheule (2005) examined the idea that an actual neurotic structure exists prior to the trauma and serves as a precondition for the development of PTSD. Actual neurosis is the inability to process the arousal that is experienced. The authors hypothesized that PTSD would occur in individuals who had a preexisting psychological structure that could be understood in terms of actual neurosis. After conducting an empirical review using a large scale epidemiology study (N=3,021), 60% of patients diagnosed with PTSD had some primary disorder before the traumatic event occurred (Verhaeghe & Vanheule, 2005). Similarly, the

researchers concluded that automatic or traumatic anxiety and/or somatic equivalents of anxiety in combination with the absence of some form of psychological processing, exacerbate symptoms of PTSD (Verhaeghe & Vanheule, 2005). This study is significant since it can provide the Army a means to screen for a preexisting condition that may lead to the development of PTSD.

Pole et al. (2007) examined the role of childhood trauma and emotional response to startling sounds. This study provides evidence that past trauma can also affect an individual's propensity to develop PTSD in the future. The researchers exposed 90 healthy police cadets to startling sound under the notion of increasing the threat of shock. They collected data on eye blink electromyogram, skin conductance, and heart rate. When compared to those who did not experience childhood trauma (N=65), police cadets with trauma (N=25) reported less positive emotions and showed a greater skin conductance response. These results are important because they show how trauma may have long lasting effects on an individual. It may be necessary to check an individual's history to see if they have experienced such trauma.

In terms of resilience, Dekel (2007) examined stress among military wives and their husbands' PTSD. The two groups that participated in the study consisted of 87 wives of prisoners of war (POWs) and 74 control veterans. The wives' husbands were POWs in the 1973 Yom Kippur War. The empirical findings suggest that the wives of POWs experienced far more stress and posttraumatic growth (PTG) than their counterparts. The explanation for this finding is that the wife must care for her suffering partner and thus internalizes the suffering as her own. As for PTG, Dekel (2007) theorized that the levels of PTG increase as the wife takes on added responsibilities of work, caring for her family, and growing closer to her husband. Therefore it infuses her life with meaning.

Hobfoll et al. (2009) conducted a similar study on Jews and Arabs in Israel and examined resilience during an ongoing threat. The study consisted of 709 participants who experienced some form of a terrorist threat. The researchers collected data through a survey instrument via telephone. In addition to collecting demographic data, they asked the participants if they had experienced some form of terrorism, and if yes, they asked if there was some form of economic loss and if they had social support. The results were that 22.1% exhibited little or no symptoms of traumatic stress, 13.5% exhibited initial symptoms, though none were problematic, and 54% were initially stress-free but began to experience some form of distress after the incident. Consistent predictors in showing resilience to PTSD were less psychosocial resources lost and a majority status, followed by greater socioeconomic status and greater support networks.

Coifman, Bonanno, Ray, & Gross (2007) studied repressive coping techniques and whether or not they promote resilience. The study focused on the ability of individuals to redirect attention away from a negative experience. The sample consisted of 120 participants, which consisted of 66 bereaved and 54 non-bereaved individuals. They were separated based on gender, age, and demographic characteristics. The participants were required to complete a self-report questionnaire, a friend rating, and then an interview. The results of the study showed that repressive coping predicted fewer psychological symptoms. Repressive coping was also predictive of better longitudinal adjustment among bereaved participants, suggesting that it serves as a buffer to distress.

Resilience and Factors Contributing to Growth

Even though PTSD is important to understand, it is more beneficial to understand those who have undergone some form of posttraumatic growth. Resilience is defined as a set of processes that enables good outcomes in spite of serious threats (Masten, 2001). Resilience is

significant because it gives individuals the ability to increase performance, optimizes health protection and readiness, decreases operational risk, and reduces first term attrition (Lukey & Tepe, 2008). Understanding those who have developed resilience is necessary so researchers can find factors that can transfer from one person's traumatic growth to someone who experiences maladaptive behaviors. Analyzing the factors involved in posttraumatic growth helps to develop improved measurement techniques as well as new training programs that combat stress while one is engaged in the operational environment. Resilience training can help individuals who already experience some form of PTSD.

Resilience can occur from experiencing a traumatic event or result from one's socioeconomic, educational, or family background. One study on resilience in emerging adults discusses how parents, communities, and society can influence adolescents as they transition into adulthood (Masten, Obradovic, & Burt, 2006). The concept of resilience refers to the adaptation that occurs in the context of a serious threat to functioning or development. The researchers divided resilience into two fundamental factors: First, one in which the individual is adapting adequately or is relatively stable, and second one in which there is no significant threat to normal functioning. These two factors give rise to the issues that a young adult must face and how they stabilize these issues within their life. The researchers recognized factors of resilience within the transition into adulthood as: U.S. society, academic achievement, friendships, conduct, work, and relationships. As a result of all these factors, analyzing resilience was divided into variable-focused and person-focused approaches. A variable-focused approach is how an individual functions in one domain over time, while a person-focused approach focuses on how an individual is doing and what combinations of problems and achievements affect that individual.

As result of historical and longitudinal research conducted by Masten, Obradovic, and Burt (2006), resilience emerges in developing adults due to several factors. Achievements in the developmental tasks of adolescence provide a strong foundation for adulthood. Children who already exhibit resilience are more likely to develop into adults with that trait. Also, adults who do not exhibit resilience can still have it emerge as they go through early adulthood due to adolescence transition factors such as motivation, adult support, and contextual opportunities that create conditions in which the individual can change their life course. These findings are important since some of these transitioning adults could join the armed services. The fact that they would join could be the pivotal moment in their life and this positive change could therefore create resilience.

Researchers refer to how a person responds to a specific event as behavioral resilience. This type of resilience includes personality and the different coping mechanisms that individuals use to deal with stress. Flexible adaptation is an example of behavioral based resilience. Flexible adaptation is the capacity to shape and modify one's behavior to meet the demands of a given stressor (Westphal, Bonanno, and Bartone, 2008). There are two types of flexible adaptation: appraisal-based flexibility and pragmatic coping. Appraisal-based focuses on reducing the negative impact of a stressful event by viewing the event in way that promotes active engagement and enables individuals to protect their self esteem. Pragmatic coping represents the 'whatever it takes' mentality to handling a traumatic event.

Other ways that people build resilience is through their outlook on the situation. Remaining optimistic during a traumatic event is an effective way of managing stress (Westphal, Bonanno, and Bartone, 2008). The ability to hold a positive attitude about the future can allow the individual to drive through the stressor. One negative aspect of optimism is that it can

underestimate the seriousness of a threatening situation, causing individuals to do little to actually fix it. Another stress coping mechanism is hardiness. Hardy individuals remain positive about an event and believe that they can control that event (Westphal, Bonanno, and Bartone, 2008). Hardy individuals demonstrate commitment to activities, relationships, and themselves by setting goals and living by specific values. They seek meaning in their lives and view threats as challenges. People who demonstrate hardiness also have strong social support.

Social support, education, and personal characteristics all play an important role in developing individuals with resilient qualities. Researchers have recently developed a program geared towards creating resilience within individuals who are at risk of experiencing a traumatic event. The program is the Master Resilience Trainer (MRT) and its aim is to build resilient qualities in Soldiers.

The MRT is a course that will provide non-commissioned officers (NCOs) the necessary skills to teach the fundamentals of resilience to others. The course is a foundation to the Comprehensive Soldier Fitness (CSF) program, discussed later in this paper, and consists of three pillars which include preparation, sustainment, and enhancement (Reivich, Seligman, & McBride, 2011). The MRT course is design to provide training skills necessary to understanding and developing resilience to a stressor. It also introduces concepts that the Soldier can use throughout their deployment and eventually throughout their life.

Research conducted in the 1970s shows that resilience is teachable (Reivich, Seligman, & McBride, 2011). The factors that contribute to resilience include optimism, problem solving, faith, and empathy, to name a few. The MRT incorporates these factors along with other elements used in the Penn Resilience Program (PRP). Central to the PRP is the Albert Ellis' ABC model which holds that beliefs about events drive our actions and emotions. This model

focuses on adversity-belief-consequence and can explain how people view the positive and negative events in their lives. Studies have shown how the PRP can reduce anxiety, depression, and conduct problems (Reivich, Seligman, & McBride, 2011).

The intent behind the MRT program is to teach NCOs to take the skills learned and apply them to their junior Soldiers. These skills will presumably enhance the Soldier's ability to handle adversity and prevent depression and PTSD (Reivich, Seligman, & McBride, 2011). The MRT is broken down into components. The MRT preparation component is the first five days and consists of NCOs attending large and small group sessions and discussing what they have learned in the sessions. The modules include training on resilience, building mental toughness, identifying character strengths, and strengthening relationships. After the five day course is complete, the next phase focuses on teaching Soldiers these skills. These three days involve role-playing, discussions, and practical exercises, which facilitates active learning and shows the NCOs that practice is necessary to full grasp the material. The next component is sustainment, which takes place on day nine of the course. It is especially important since it covers how these skills affect one's military career and how to apply them to certain military contexts. NCOs learn in this stage how to identify when an individual is encountering significant challenges and how to adapt the MRT skills when the individual needs more support. Lastly, the MRT focuses on enhancement, which takes place on the last day of the course. It introduces key skills such as mental foundation, confidence building, goal setting, attention control, and energy management. Programs such as the MRT can help change the way the general U.S. populace thinks about PTSD and having access to help. Testing, teaching, and developing resilience is necessary to keep Soldiers within the fight. Next our paper will focus on a method to test the effectiveness of

this program and the feasibility of concentrating on Soldier resilience through Comprehensive Soldier Fitness initiatives.

Fear and PTSD

In order to correctly analyze the symptoms of PTSD through stabilometric platform studies, it is valuable to understand the underlying mechanisms of phobic disorder. Understanding phobic disorder is important because it is an anxiety disorder, and research from phobic disorder may help guide studies in PTSD. Marks (1987) defines a phobia as "an intense fear that is out of proportion to the apparent stimulus, cannot be explained or reasoned away, and leads to avoidance of the feared stimulus." Fear is more about the appraisal of a situation rather than the actual danger involved, and the phobia is the disabling aspect of such fears (Beck, Emery, & Greenberg, 1985).

The group of phobias this paper is concerned with is specific phobias. These phobias are common and can include fears of snakes, spiders, heights, etc. (Marks, 1987). The majority of the specific phobia studies have been on animal phobics, in which there seems to be a greater incidence in women versus men past puberty (Marks, 1987). Additionally, a study by Swanson (1986) found that specific phobias can occur in just about anyone regardless of their demographics. Marks (1987) discusses the fact that most of those with animal phobias are not disabled in their everyday lives and their phobia can lay dormant for decades. This means that while people know that they fear something, it takes a stimulus to trigger the fearful response. The key to determining the severity of the disorder in this case is in how prevalent the feared stimulus is in their everyday life, which in turn affects their ability to function normally. Nonetheless, certain stimuli can exacerbate even a hidden problem and cause a person to relive the event that caused the phobia in the first place (Beck, Emery, & Greenberg, 1985).

In the studies referenced later in this paper, the underlying theme is understanding the severity of the phobia through exposure to stimuli. This idea links closely to PTSD because of traumatic phobias. Marks (1987) defines traumatic phobias as "broad-spectrum disturbances after extremely traumatizing experiences." One such experience is combat. The specific fears discussed above are part of the symptoms of PTSD and combat phobias are also inherent in war in both air and ground combat (Marks, 1987). The link between PTSD and specific phobias is that they are both anxiety disorders. The main distinction between the two is that phobias do not spread to include "nonphobic disturbance[s]" (Marks, 1987). The key idea is that phobias may be unconscious and detected empirically, and since PTSD is linked to combat phobias, stabilometric experimental methods could prove useful in detecting resilience.

Psychological Constructs Evident in Stabilometric Platform Fear Studies

Stabilometric platforms are capable of measuring unconscious fears. The first important principle of the platform is the concept of balance. According to Chiari, Rocchi, and Cappello (2004) stabilometry uses a platform of force transducers to measure the center of pressure and ground-reaction vector in order to glean information on an individual's balance. Balasubramaniam and Wing (2002) define balance as "the equilibrium resulting from the matching of torques, which can be organized in anticipation of . . . or as a reaction to . . . the effects of postural disturbance." What we are interested in measuring is postural sway, defined by Riley, Mitra and Turvey (1997) as "forward and backward and side-to side movements of the center of pressure."

An important point to note in the following studies is that the postural disturbances are not only physical, but are also emotional. The underlying principle of emotion that applies to our proposed research design is that those who have a positive or negative reaction to a stimulus also

exhibit behavior in which they move towards or away from that stimulus (Elliott & Covington, 2001). This shows that the underlying behavior uses approach or avoidance motivation determined from an individual's appraisal of the stimuli (Elliott & Covington, 2001). According to Bradley, Codispoti, Cuthbert, and Lang (2001), the behavioral responses associated with avoidance include withdrawal, escape, and attack, while the responses associated with an approach motivation are ingestion, copulation, and caregiving. In terms of measuring PTSD with emotionally stimulating pictures, the expectation is that people will react with a particular behavior and this will be indicative of their appraisal of the stimulus. Since there are healthy people who may have a fear of war, they key is to determine when normal reactions become maladaptive.

An additional aspect of postural stabilometry studies is vision. Vision is the primary sense relied upon in these studies through the use of affective photographs. Most of the research done thus far involving the visual system and balance has been on moving images which offer a conflicting interpretation of the environment from what the vestibular senses are telling the individual (Redfern, Yardley, & Bronstein, 2001). However, it is important to realize that there is a link between vision and balance by noting that the pictures we intend to use in our proposed experiment will consist of realistic battle scenes, aimed at evoking unconscious emotional responses that would allow us to determine the extent of PSTD-type symptoms an individual is experiencing. These photographs will be indicative of a "fixed visual environment," which Redfern et al. (2001) says should reduce postural sway. A final factor to note is that those with anxiety disorders exhibit an increased amount of postural sway because they rely more on their visual system for balance (Redfern et al., 2001). This means that in our experiment we would not

expect healthy individuals to exhibit a large amount of postural sway since we are showing them still images.

Finally, one must understand the interaction between arousal and picture viewing. In order for the individual to appropriately process the picture, they must have an adequate level of arousal and attention toward the task (Lang, Bradley, & Cuthbert, 1997). Lang et al. (1997) state that exposure to an arousing new picture evokes significantly slower reaction time responses. Lang et al. (1997) suggest that more attentional resources are devoted to arousing images, and individuals view unpleasant pictures for the same length as pleasant ones. Given that individuals devote more attentional resources to arousing pictures means that the exposure time for each picture is important because individuals could lose arousal if required to stare at neutral images for a long period of time.

Similar Studies

The study that most closely links to our proposed study is Hillman, Rosengren, and Smith (2004), which used a force platform to calculate the overall center of pressure (COP) of the body while the participant viewed a set of unpleasant, pleasant, and neutral pictures. This study also analyzed the startle blink reflex and subjective measures. A total of 36 participants, 18 male and 18 female, stood on a Kistler force plate while viewing 60 affective pictures for 6 seconds per picture. The results indicated that females showed a “progressive” movement away from the unpleasant pictures while men only moved slightly away (Hillman, Rosengren, & Smith, 2004). This is particularly interesting when you link this study to the studies which showed that specific phobias were more prevalent in women.

Another related study was conducted by Renaud, Bouchard, and Proulx (2002), who studied the tracking behavior of those who had a spider phobia and those who did not using

similar methods. Though this study did not use platform stabiliometry, it is still relevant because it analyzed the avoidance behavior of the fearful subjects. Renaud et al. (2002) states that "behavioral avoidance is one of the most objective and reliable manifestations of anxiety and phobic disorders." Participants in this study were shown a virtual reality spider and a neutral stimulus and had to track both while wearing a head-tracking device. The participants who were fearful of spiders (as subjectively measured), showed behavioral avoidance, which negatively affected their performance in the task.

Proposed Study Hypothesis

The studies using platform stabilometry are able to reflect the fears of the subject by measuring COP, but which way should the COP be for a healthy individual, towards or away from the negative stimulus? As noted earlier in the Hillman et al. (2004) study, the participants exhibited an avoidance behavior, moving away from negative pictures. Another idea, developed by Azevedo et al. (2005), is that individuals will exhibit a "freezing" behavior when viewing negative images. Azevedo et al. (2005) found evidence for this behavior as well as a decrease in heart rate which coincides with the idea of the "fight or flight" response, in which the freezing behavior helps the individual to make the choice for what to do in a particular situation. This period of freezing allows the individual to properly analyze the situation, or picture, and make a choice of how to react based on memory (Azevedo et al., 2005).

The key to understanding how to detect how well a person is coping with PTSD would be to see the degree of their avoidance behavior when viewing an unpleasant stimulus. An individual with PTSD would react differently to exposure of images of mutilation and death than a person who is more resilient to combat stress. A healthy individual would freeze in response to negative stimuli according to Azevedo et al. (2005), so an unhealthy individual would exhibit

more maladaptive, avoidant behavior to the same negative stimuli. We therefore hypothesize that as an individual undergoes treatment for PTSD, their behavior in response to negative pictures of combat would become less and less avoidant.

Additional Factors to Consider

While we hypothesize that the baseline behavior we expect in our experiment will be a "freezing" behavior, there are several factors that must be taken into account, and thus adjust our study to reflect. The first factor is that of sex differences. As previously discussed, males and females do not have the same level of avoidant behavior in response to phobias. Bradley, Codispoti, Sabantinelli, and Lang (2001) found that women had a more pronounced avoidant reaction to unpleasant images regardless of the type of image. Their study supports the hypothesis that women are more emotionally expressive when viewing negative images because they have a stronger avoidance motivation (Bradley, Codispoti, Sabantinelli, & Lang 2001).

Additionally, Fischer and Manstead (2000) studied the roles of the sexes in Western and non-Western cultures and found that women, despite the culture, had more intense emotions for a longer duration, and they expressed their emotions more openly than men. The reason for the differences in women in Western culture is because of gender roles which enforce the idea that women are emotional, while men are rational (Fischer & Manstead, 2000). This difference in the sexes means that a woman's behavioral response to unpleasant images may exhibit some normal avoidant behavior. A comparison of women known to be healthy and those who have PTSD would help to develop a baseline level of postural sway for military females.

Another factor to consider is the wide range of anthropometrics of Soldiers. Chiari, Rocchi, and Cappello (2002) discovered that platform stabilometry must take the following biomechanical factors into account: "height, weight, maximum foot width, base-of-support area,

and foot opening angle." They also found that foot placement is extremely important in order to correctly interpret data. This study mainly shows that it is important to include some of the relevant anthropometric data into our study in order to better validate the data we collect.

When conducting a study using affective images, it is also important to ensure that the participants pay appropriate attention to the images in order to gather appropriate data. Maki and Mcllroy (1996) conducted a study using platform stabilometry and tested the effect of divided attention on the task at hand. The main issue they saw in using postural sway as the variable of interest was that some participants will exhibit "test anxiety" and the results of the study can be confounded by varying levels of attention and arousal (Maki & Mcllroy, 1996). Maki and Mcllroy (1996) assert that "attention-demanding secondary tasks affect the control of postural sway by competing with the posture control system for neural resources." In the study, secondary tasks included listening to noise, listening to a book excerpt, and performing a mathematical task. The type of task mattered, and those who performed the mathematical task leaned slightly forward, which Maki and Mcllroy (1996) contributed to a stressful response and a stiffening of the legs. These findings show that the level of anxiety of a participant at the time of testing is an essential factor to regulate.

Finally, another factor that may confound a platform stabilometry study for PTSD is individual differences in equilibrium. The baseline state of posture for a typical platform stabilometry experiment consists of an individual standing upright and holding their center of mass above their base of support (Riley et al., 1997). Riley et al. (1997) asserts that "people can lean at will and maintain a lean as a stable stance," which can confound a study like ours. We must clearly define a "stable stance," since it may vary from person to person. Some people may also have poor posture compared to others, so stability may look different. This all means that we

need to ensure that the software used to collect data needs to be able to measure the postural sway from each individual's baseline, not just a generalized baseline that fails to take into account individual differences.

Proposed Study Method

Participants

Since the military and PTSD is the main focus of this study, the participants would be individuals exposed to combat. An assessment of the degree of PTSD a person exhibits and their progress while undergoing treatment will be made. Various groups, including those who do not exhibit signs of PTSD, will be needed in order to understand if our hypothesis regarding body lean is correct. Prior screening of participants who exhibit other forms of anxiety disorders or visual deficiencies will be made as this may affect study results.

The participant's post-deployment health assessment (PDHA) will determine selection. This measure assesses Soldiers after their deployment and provides healthcare providers information on which Soldiers require medical care (U.S. Department of the Army, 2008). More research can establish a baseline score which will tell us which participants to include in the study and delineate them into experimental and control groups. The proposed study is designed to determine which individuals are having appropriate and which are having inappropriate responses to combat stress.

This study fits into the idea of Comprehensive Soldier Fitness (CSF) already implemented in the Army. The intent is to test the effectiveness of CSF thorough physiological measurements, and in this case, behavioral measurements. The CSF's mission is to "develop and institute a holistic fitness program for Soldier, Families, and Army civilians in order to enhance performance and build resilience" (U.S. Department of the Army, 2010). It is our goal to test

Soldiers who have undergone CSF training in a longitudinal study. The current plan calls for testing Soldiers from 8 Brigade Combat Teams (BCTs) every six months to determine the long-term effects of CSF. There will be 100 per BCT asked to participate in the physiological screening. The different BCTs will include various levels of CSF training. Of these 100 Soldiers, some will be disqualified from stabilometric platform testing due to the above complicating factors, but we hope to garner at least 50 usable data points and we intend to follow these 50 Soldiers throughout multiple deployments and garrison duties for 2-3 years.

Apparatus

The main apparatus involved in this experiment is the stabilometric platform. The one used in Hillman et al.'s 2004 study was the Kistler Force Plate, model 9281B. Since Hillman's study, Kistler produced a newer model, the 9286B, which is better suited for our study. This platform measures ground reaction forces, movements, and centers of pressure through piezoelectric 3-component sensors (Kistler Group, 2008). Additionally, this stabilometric platform is portable, easy to use, and accurate in balance analyses (Kistler Group, 2008). The computer program used in conjunction with the Kistler 9286B is the Bioware® software. The figure on the next page shows an output from the Bioware® program for a center of pressure measurement, with the right-hand side of the graph indicating the forward lean, and the left-hand side indicating backward lean.

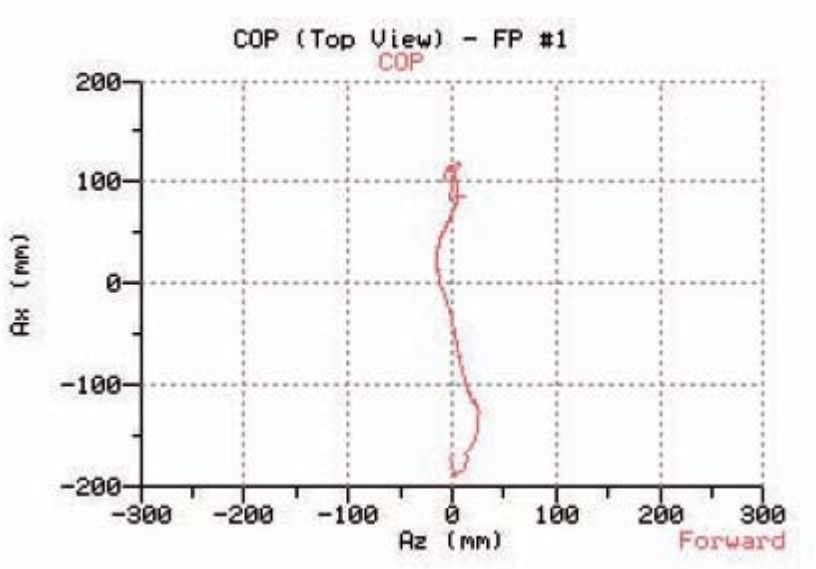

Figure 1. Sample output from the Bioware® software (Kistler Group, 2008).

Additionally, the affective pictures for the experiment will come from the Center for the Study of Emotion and Attention (1999). The request for access to the International Affective Picture System (IAPS) is online and will allow for access to color pictures classified as neutral, positive, or negative. The negative pictures for this experiment will need to relate to combat in order to rule out any specific phobias a Soldier may have, such as snakes or spiders. A resource to further aid the experimental design is Lang, Bradley, and Cuthbert (2005), in which they detail an experimental design using the IAPS.

Procedure

The intent of the experiment will be to assess the level of avoidance behavior through the use of a stabilometric platform in order to determine how well an individual with PTSD has been coping with the aid of CSF. This experiment would test both Soldiers trained under the CSF program, and those who have not, in order to determine whether there are any differences in avoidant behavior. We hope to obtain at least 50 usable data points per BCT in order to conduct a 2-3 year longitudinal study of the effectiveness of the CSF program. The methodology for

testing will closely align to Hillman et al. (2004), and will allow the experimenters to easily pair additional physiological measurements, such as the startle blink reflex, to this experiment. We would suggest adding a simple secondary task, such as having the Soldiers state whether the picture is pleasant, unpleasant, or neutral, in order to prevent them from consciously altering their posture during testing. We would require a lab at the deployed locations of the BCTs in this study as well. This experiment would take place every six months, including while Soldiers are on deployment, when it is tactically feasible to do so. Cadets in the Engineering Psychology Program at the United States Military Academy could further refine and test this proposed methodology on the cadet population, which contains some combat veterans.

Annotated References

Azevedo, T.M., Volchan, E., Imbiriba, L.A., Rodrigus, E.C., Oliveira, J.M., Oliveira, L.F., Lutterback, L.G., & Vargas, C.D. (2005). A freezing-like posture to pictures of mutilation. *Psychophysiology 42,* 255-260.

This article explores the hypothesis that people would "freeze" when they see disturbing images. They used a stabilometric platform, which is also important to look at for our project. This research could help us identify which type of behavior is resilient if the common behavior is to freeze.

Balasubramaniam, R., & Wing, A. M. (2002). The dynamics of standing balance. *Trends in Cognitive Science, 6,* 531–536.

This paper provides important background on standing and the muscles involved. It can give us insight into how to apply the suggested experiment in the Army. The effects of muscle fatigue and other possible perturbations can skew the results of a future study.

Beck, A.T., Emery, G., & Greenberg, R.L. (1985) Anxiety disorders and phobias: A cognitive perspective. New York: Basic Books.

This book discusses various anxiety disorders and cognitive behavioral therapies used to treat these disorders.

Bentley, S. (2005). A short history of PTSD: From thermopylae to hue Soldiers have always had a disturbing reaction to war. *The VVA Veteran,* 1-9.

This article provided historical references to PTSD and how it has always affected Soldiers on the battle field. It provides the symptoms and the common names seen throughout the changing times.

Bradley, M.M., Codispoti, M., Cuthbert, B.N., Lang, P.J. (2001). Emotion and motivation I: Defensive and appetitive reactions in picture processing. *Emotion, 1*, 276–298.

This article talks about the connection between emotional response and postural sway in addition to other physiological factors associated with viewing pictures. It is important to examine the reasons why people have differing responses to threat, which will help us to determine how to understand avoidance behavior in postural sway.

Bradley, M.M., Codispoti, M., Sabatinelli, D. and Lang, P.J. (2001). Emotion and motivation II: Sex differences in picture processing. *Emotion 1*, 300–319.

This article talks about the differences between sexes and their aversive responses to stimuli. Women tend to have more aversive reactions than men. This is important because our proposed system will have to include different variables for men and women that show who is in the "danger zone" of developing PTSD.

Center for the Study of Emotion and Attention (CSEA-NIMH). (1999). The International Affective Picture System (Digitized Photographs). The Center for Research in Psychophysiology, University of Florida, Gainesville, FL.

This is the actual location to get the photographs for the experiment. We plan to use this website to find some photographs that would help us to predict PTSD.

Charney, D.S. (2004). Psychobiological mechanisms of resilience and vulnerability. *American Psychiatric Association,* 2, 368-391.

This article discusses biological responses to stress. These factors include neurotransmitters, neuropeptides, and hormones which are all linked to stress.

Chiari, L., Rocchi, L., & Cappello, A. (2002). Stabilometric parameters are affected by anthropometry and foot placement. *Clinical Biomechanics*, *17*, 666–677.

This article discusses some of the factors that must be understood when measuring postural sway with a stabilometric board. This article can give us the proper anthropometric dimensions that are needed prior to running this experiment in order to ensure that the data collected is correct.

Coifman, K., Bonanno, G, Ray, R., & Gross, J. (2007). Does repressive coping promote resilience? Affective-autonomic response discrepancy during bereavement. *Journal of Personality and Social Psychology,* 92, 745-758.

This article provides insight into repressive coping techniques and whether or not they promote resilience.

Creamer, M & Forbes, D. (2004). Treatment of posttraumatic stress disorder in military and veteran Populations. *Psychotherapy: Theory, Research, Practice, Training*, 4, 388-398.

This article focused on how to reduce the symptoms of PTSD. It provided techniques in relieving and/or eliminating the symptoms.

Damore, J. P. (2010). About post traumatic stress disorder. 1-30.

This presentation provided insight into the history, etiology, and epidemiology of PTSD.

Dekel, R. (2007). Post traumatic distress and growth among wives of prisoners of war: The contribution of husbands' posttraumatic stress disorder and wives' own attachment. *American Journal of Orthopsychiatry,* 77, 419-426

This article focused on how the wives of POWs became more resilient when their husbands returned home. It gave insight into how the wives took care of their husbands and how their husbands return home gave them a higher purpose in life.

Elliott, A.J. & Covington, M.V. (2001). Approach and avoidance motivation. *Educational Psychology Review 13* (2), 73-92.

This article gives insight into the different types of motivations that influence emotional appraisal. It details both approach and avoidance motivation and its link to behavior.

Flack, W.F., Litz, B.T., & Keane, T.M. (1998). Cognitive-behavioral treatment of war zone related posttraumatic stress disorder: A flexible, hierarchical approach. In V.M. Follote, J.I. Ruzek, & F.R. Abueg *(Eds.), Cognitive- Behavioral Therapies for Trauma* (79–99). New York, New York: Guilford Press.

This article provides insight into psycho education and how these methods could provide necessary explanations behind how and why the person developed PTSD.

Fischer, A. H., & Manstead, A. S. R. (2000). The relation between gender and emotions in different cultures. In A. H. Fischer (Ed.), *Gender and Emotion: Social Psychology Perspectives* (pp. 71–94). New York: Cambridge University Press.

This chapter talks about the reasons why women behave differently than men. It gives another perspective into sex differences and can give some insights into why the sex differences are present.

Friedman, M. J., Schnurr, P.P, & McDonagh-Coyle, A. (1994). Posttraumatic stress disorder in the military veteran. *Iraqi War Clinician Guide* 17(2), 264-277.

This article provides empirical evidence behind those who develop PSTD within a general population who have experienced war.

Hillman, C.H., Rosengren, K.S., & Smith, D.P. (2004). Emotion and motivated behavior: Postural adjustments to affective picture viewing. *Biological Psychology 66*, 51-62.

This study helps to shed light on the differences between men and women in terms of postural changes when viewing affective images. This will help to interpret the information from the postural sway board and help the future user compensate for sex differences.

Hobfoll, S. E., Johnson, R.J., Hall, B.J., Palmieri, P.A., & Nisim, C.D. (2009). Trajectories of resilience, resistance, and distress during ongoing terrorism: The case of Jews and Arabs in Israel. *Journal of Consulting and Clinical Psychology* 77(1), 138-148.

This study was concerned with the examination of Jews and Arabs in Israel who developed resilience due to an ongoing threat within their country.

Keane, T.M., Fairbank, J.A., Caddell, J.M., & Zimering, R.T. (1989). Implosive therapy reduces symptoms of PTSD in Vietnam combat veterans. *Behavior Therapy,* 20, 245-260.

After a study of combat veterans it was found that there was a significant improvement in their symptoms after image exposure.

Kistler Group. (2008) *Multicomponent Force Plate User's Manual – Type 9286B.* Retrieved from http://www.kistler.com/mediaaccess/9286B__000-713e-09.08.pdf

This is the user's manual that describes the usage of the stability platform that will best suit our experiment's needs. This manual details some of the important specifications that prove that it is reliable, flexible, and worth the acquisition cost.

Lang, P.J., Bradley, M.M. & Cuthbert, B.N. (1997). Motivated attention: Affect, activation, and action. In P.J Lang, R.F. Simons, & M. Balaban (Eds.), *Attention and orienting: Sensory and motivational processes* (pp. 97-135). Mahwah: Lawrence Erlbaum Associates, Publishers.

This book chapter discusses the link between emotion and attention. It is important to understand the underlying motives of our participants because we want to ensure that adequate attention will be given to the task at hand. This chapter also details how people process pictures.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (2005). International affective picture system (IAPS): Instruction manual and affective ratings (Technical Report No. A-4). Gainesville, FL: The Center for Research in Psychophysiology, University of Florida.

This is a technical manual that describes the IAPS that has a collection of emotionally stimulating images. This manual will help us to understand how to implement the photos into our experiment.

Maki, B.E. & Mcllroy, W.E. (1996). Influence of arousal and attention on the control of postural sway. *Journal of Vestibular Research: equilibrium and orientation 1,* 53-59.

This article discusses more of the factors affecting postural sway and how to determine whether the participant is under stress in a particular position. This will help us to further understand the results from a postural sway board study.

Marks, I.M. (1987). *Fears, phobias, and rituals: Panic, anxiety, and their disorders.* New York: Oxford University Press.

Chapter 9 in this book is particularly relevant to our project because it discusses the difficulties with classifying phobic disorders. This may help us to provide a link to phobia diagnosis and PTSD. Additionally, Chapter 12 talks about traumatic phobias including combat phobias. Finally, Chapter 1 can give us a pretty in-depth look at the different developments and need for fears.

Masten, A. S., Obradovic, J., & Burt, K. B. (2006). Resilience in emerging adulthood: developmental perspectives on continuity and transformation. In: J.J. Arnett & J. L. Tanner (Eds), *Emerging adults in America: Coming of age in the 21st century*, (pp. 173-190). Washington, DC: American Psychological Association.

This chapter discusses how young adults build resilience through their developmental stages. Factors such as education, family, and sense of purpose all play a role.

Meichenbaum, D. (1985). *Stress Inoculation Training.* New York: Pergamon Press.

This article provides insight into symptom management and how it provides a useful first step in treating PTSD.

Merrill, L.L., Newell, C.E., Milner, J.S., Koss, M.P., Hervig, L.K., Gold, S.R., et al. (1998). Prevalence of premilitary adult sexual victimization and aggression in a Navy recruit sample. *Military Medicine,* 163, 209-212.

This article discusses how the abuse before military service can be detrimental to the individuals overall performance and how it causes mistrust against the general populace. The article also provides insight into fixing the trauma from an abusive past.

Ozer, E.J., Best, S.R., & Lipsey, T.L. (2008). Predictors of posttraumatic stress disorder and symptoms in adults: A meta analysis. *Psychological Trauma: Theory, Research, Practice, and Policy* 5(1), 3-36.

This article provides estimates of those who are afflicted with PTSD. It also describes the symptoms of PTSD and who is most likely to develop it.

Pole, N., Neylan, T.C., Metzler, T.J., Best, S.R. & Hasse, C.H. (2007). Associations between childhood trauma and emotion modulated psychophysiological response to startling sounds: A study of police cadets. *Journal of Abnormal Psychology* 116(2), 352-361.

This study focuses on childhood trauma and the emotional response to startling sounds. The authors exposed 90 healthy police cadets to startling under the increased threat of shock.

Redfern, M.S., Yardley, L. & Bronstein, A.M. (2001). Visual influences on balance. *Journal of Anxiety Disorders 15***,** 81–94.

This articles talks about how certain anxiety disorders affect balance. It is important as well for understanding the link between vision and balance and will help us to defend the use of visual stimuli in our experiment.

Reivich, K. J., Seligman, M. E., & McBride, S. (2011). Master resilience training in the United States Army. *American Psychologist, 66* (1), 1-25.

This article provides insight into the army's MRT program that will be utilized to combat stress and build resilience amongst the troops.

Renaud, P., Bouchard, S., & Proulx, R. (2002). Behavioral avoidance dynamics in the presence of a virtual spider. *IEEE Transactions on Information Technology in Biomedicine, 6* (3), 235-243.

This article discusses avoidance behavior by those who are fearful of spiders and those who are not. It is the same underlying process involved in the sway board, simply using different techniques.

Riley, M.A., Mitra, S., Stoggregen, T.A., & Turvey, M.T. (1997) Influences of body lean and vision on unperturbed postural sway. *Motor Control, 1,* 229-246

This article introduces us to some of the concepts behind postural sway and links how the visual system affects postural sway. This is important for our research because the method of analyzing subjects will include showing them emotional images.

Rothbaum, B.O., Meadows, E.A., Resick, P., & Foy, D. (2000). Cognitive-Behavioral therapy. In E. B. Foa, T. M. Keane, & M. J. Friedman (Eds.), Effective treatments for PTSD: Practice guidelines from the International Society for Traumatic Stress Studies (pp 60–83). New York: Guilford.

This article discusses the use of exposure treatments to treat anxiety disorders and these prolonged exposure techniques provide a successful component to combating PTSD.

Swanson, G.E. (1986). Phobias and related symptoms: Some social sources. *Sociological Forum, 1(*1), 103-130.

The author examines how familial and general societal relations may thwart one's ability to pursue goals and thus translate to phobias.

Tolin, D. F. & Foa, E.B. (2008) Sex differences in trauma and posttraumatic stress disorder: A quantitative review of 25 Years of research. *Psychological Trauma: Theory, Research, Practice, and Policy 5* (1), 37-85.

This research discusses who is likely to develop PTSD. It provides empirical evidence and demonstrates that women are more likely to develop PTSD, but there are higher incidents amongst men since they are more likely to be exposed to traumatic events.

U.S. Department of the Army (2008). *Post-Deployment Health Assessment (PDHA).* (DD Form 2796). Washington, DC: Author.

This is the health assessment that the Soldiers will take after they are deployed. This assessment is important in determining which participants should be used for our experiment. This health assessment tells us which Soldiers show symptoms of PTSD.

U.S. Department of the Army. (2010). *Comprehensive Soldier Fitness: Strong Minds, Strong Bodies.* Retrieved from: http://www.army.mil/csf/index.html

This is the website that gives us the mission and basic information behind the CSF program. This helps us to defend where our experiment will fit.

Verhaeghe, P. & Vanheule, S. (2005). Actual neurosis and PTSD: The impact of the other. *Psychoanalytic Psychology 22* (4), 493-507.

This article deals with the neurotic structure prior to the trauma. It was concluded that symptoms of PTSD are exacerbated by the automatic or traumatic anxiety in combination with the absence of some form of physical processing.

Westphal, M., Bonanno, G., and Bartone, P. Resilience and Personality. In B. Lukey & V. Tepe (Eds.), *Biobehavioral Resilience to Stress* (43-55). New York, New York: CRC Press.

This chapter discusses how character traits and an individual's outlook can affect resilience.